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Secondary School Examination - 2020
Marking Scheme- MATHEMATICS BASIC
Subject Code : 241 Paper Code: 430/4/1,2,3

General Instructions:

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.**Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best effortsin this process.**

2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**

3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

4. Evaluators will mark(√) wherever answer is correct. For wrong answer 'X"be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**

5. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.

6. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

7. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.

8. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

9. A full scale of marks 0 - 80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

10. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).

11. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totaling of marks awarded on a reply.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

12. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.

13. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

14. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

15. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

16. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

QUESTION PAPER CODE 430/4/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

Question numbers 1 to 20 carry 1 mark each.

Choose the correct option in question numbers 1 to 10.

1. Given that HCF (156, 78) = 78, LCM (156, 78) is

(A) 156 (B) 78 (C) 156 × 78 (D) 156 × 2

Sol. (A) 156 1

---

2. Sides of two similar triangles are in the ratio 4 : 9. Areas of these triangles are in the ratio

(A) 4 : 9 (B) 2 : 3 (C) 81 : 16 (D) 16 : 81

Sol. (D) 16 : 81 1

---

3. The distance between the points (– 1, – 3) and (5, – 2) is

(A) $\sqrt{61}$ units (B) $\sqrt{37}$ units (C) 5 units (D) $\sqrt{17}$ units

Sol. (B) $\sqrt{37}$ units 1

---

4. The discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$ is

(A) – 8 (B) 10 (C) 8 (D) $2\sqrt{2}$

Sol. (A) –8 1

OR

Roots of the quadratic equation $2x^2 - 4x + 3 = 0$ are

(A) real and equal (B) real and distinct (C) not real (D) real

Sol. (C) Not Real 1

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5. Number of zeroes of the polynomial p(x) shown in Figure-1, are

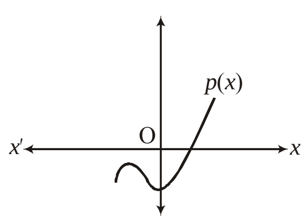

Figure 1

(A) 3 (B) 2 (C) 1 (D) 0

Sol. (C) 1 1

---

6. **A dice is thrown once. The probability of getting an odd number is**

(A) 1 **(B) $\frac{1}{2}$** **(C) $\frac{4}{6}$** **(D) $\frac{2}{6}$**

Sol. (B) $\frac{1}{2}$ 1

---

7. **The value of k for which the equations $3x - y + 8 = 0$ and $6x + ky = -16$ represent coincident lines, is**

(A) $-\frac{1}{2}$ **(B) $\frac{1}{2}$** **(C) 2** **(D) – 2**

Sol. (D) –2 1

---

8. **If $\sin A = \cos A$, $0 \le A \le 90°$, then the angle A is equal to**

(A) 30° **(B) 60°** **(C) 0°** **(D) 45°**

Sol. (D) 45° 1

---

9. **The second term from the end of the A.P. 5, 8, 11, ..., 47 is**

(A) 50 **(B) 45** **(C) 44** **(D) 41**

Sol. (C) 44 1

---

10. **Total surface area of a solid hemisphere is**

(A) $3\pi r^2$ **(B) $2\pi r^2$** **(C) $4\pi r^2$** **(D) $\frac{2}{3}\pi r^3$**

Sol. (A) $3\pi r^2$ 1

Fill in the blanks in question numbers 11 to 15.

11. **The roots of the equation, $x^2 + bx + c = 0$ are equal if _______.**

Sol. $b^2 = 4c$ 1

---

12. **The mid-point of the line segment joining the points (– 3, – 3) and (– 3, 3) is _______.**

Sol. (–3, 0) 1

---

13. **The lengths of the tangents drawn from an external point to a circle are _______.**

Sol. Equal 1

---

14. **For a given distribution with 100 observations, the 'less than' ogive and 'more than' ogive intersect at (58, 50). The median of the distribution is _______.**

Sol. 58 1

---

15. In the quadratic polynomial $t^2 - 16$, sum of the zeroes is _______.

Sol. 0 1

Answer the following question numbers 16 to 20.

16. Write the 26th term of the A.P. 7,4,1, –2, ...

Sol. $d = -3$ $\frac{1}{2}$

$a_{26} = -68$ $\frac{1}{2}$

---

17. Find the coordinates of the point on x-axis which divides the line segment joining the points (2, 3) and (5, – 6) in the ratio 1 : 2.

Sol. Let the point on x-axis be $(x, 0)$ $\frac{1}{2}$

$\therefore$ Required point is $(3, 0)$ $\frac{1}{2}$

---

18. If $\operatorname{cosec} \theta = \frac{5}{4}$, find the value of $\cot \theta$.

Sol. $\cot^2 \theta = \frac{25}{16} - 1 = \frac{9}{16}$ $\frac{1}{2}$

$\cot \theta = \frac{3}{4}$ $\frac{1}{2}$

OR

Find the value of sin 42° – cos 48°.

Sol. $\sin 42° = \cos (90° - 42°) = \cos 48°$ $\frac{1}{2}$

$\therefore \sin 42° - \cos 48° = 0$ $\frac{1}{2}$

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19. The angle of elevation of the top of the tower AB from a point C on the ground, which is 60 m away from the foot of the tower, is 30°, as shown in Figure-2. Find the height of the tower.

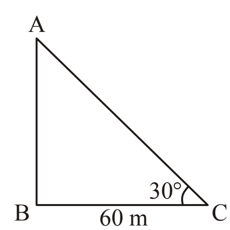

Figure 2

Sol. $\tan 30° = \dfrac{AB}{60°}$ $\frac{1}{2}$

$\Rightarrow AB = \dfrac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m $\frac{1}{2}$

20. **In Figure-3, find the length of the tangent PQ drawn from the point P to a circle with centre at O, given that OP = 12 cm and OQ = 5 cm.**

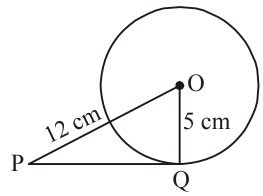

Figure 3

Sol. $PQ^2 = 144 - 25 = 119$ $\frac{1}{2}$

$\therefore$ PQ = $\sqrt{119}$ units $\frac{1}{2}$

SECTION B

Question numbers 21 to 26 carry 2 marks each.

21. **A cylindrical bucket, 32 cm high and with radius of base 14 cm, is filled completely with sand. Find the volume of the and. (Use $\pi = \dfrac{22}{7}$)**

Sol. Volume of sand = $\dfrac{22}{7} \times 14 \times 14 \times 32$ 1

$= 19712 \text{ cm}^3$ 1

22. **In Figure-4, ΔABC and ΔXYZ are shown. If AB = 3.8 cm, AC = $3\sqrt{3}$ cm, BC = 6 cm, XY = $6\sqrt{3}$ cm, XZ = 7.6 cm, YZ = 12 cm and ∠A = 65°, ∠B = 70°, then find the value of ∠Y.**

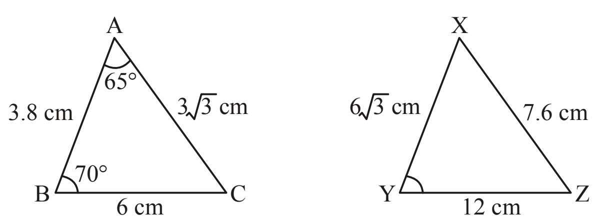

Figure 4

Sol. $\Delta ABC \sim \Delta XZY$ 1

$\Rightarrow \angle Y = \angle C = 180° - (\angle A + \angle B)$ $\frac{1}{2}$

$\Rightarrow \angle Y = 45°$ $\frac{1}{2}$

OR

If the areas of two similar triangles are equal, show that they are congruent.

Sol. Let $\Delta ABC \sim \Delta PQR$

$$\therefore \frac{ar(ABC)}{ar(PQR)} = 1 = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2} \qquad 1$$

$\Rightarrow AB = PQ,\ BC = QR,\ AC = PR$ $\qquad \frac{1}{2}$

$\therefore\ \Delta ABC \cong \Delta PQR$ (SSS congrence rule) $\qquad \frac{1}{2}$

23. If sec 2A = cosec (A – 30°), 0° < 2A < 90°, then find the value of ∠A.

Sol. $\sec 2A = \text{cosec}\,(A - 30°)$

$\Rightarrow \text{cosec}\,(90° - 2A) = A - 30°$ $\qquad 1$

$\Rightarrow 90° - 2A = A - 30°$ $\qquad \frac{1}{2}$

$\Rightarrow \angle A = 40°$ $\qquad \frac{1}{2}$

24. Show that every positive even integer is of the form 2q and that every positive odd integer is of the form 2q + 1, where q is some integer.

Sol. Let 'a' be any positive integer and $b = 2$

Using Euclid's Division lemma

$a = 2q + r,\ r = 0,\ 1$ $\qquad 1$

$\therefore\ a = 2q$ or $2q + 1$

Because 2q is an even integer and every positive ineger is either even or odd.

$\therefore\ a = 2q + 1$ is an odd positive integer. $\qquad 1$

25. How many two-digit numbers are divisible by 6?

Sol. Two digit numbers divisible by 6 are 12, 18, 24,...96 $\qquad 1$

$96 = 12 + (n - 1) \times 6$ $\qquad \frac{1}{2}$

$\Rightarrow n = 15$ $\qquad \frac{1}{2}$

OR

In an A.P. it is given that common difference is 5 and sum of its first ten terms is 75. Find the first term of the A.P.

Sol. $S_{10} = 75$ and $n = 10$ $\frac{1}{2}$

$$\frac{10}{2}(2a + 9 \times 5) = 75$$ 1

$\Rightarrow a = -15$ $\frac{1}{2}$

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26. The following table shows the ages of the patients admitted in a hospital during a year:

Age (in years):	**5 – 15**	**15 – 25**	**25 – 35**	**35 – 45**	**45 – 55**	**55 – 65**
Number of patients:	**60**	**110**	**210**	**230**	**150**	**50**

Find the mode of the distribution.

Sol. Modal class is 35 – 45 $\frac{1}{2}$

$$\therefore \text{ Mode } = 35 + \frac{230 - 210}{460 - 210 - 150} \times 10$$ 1

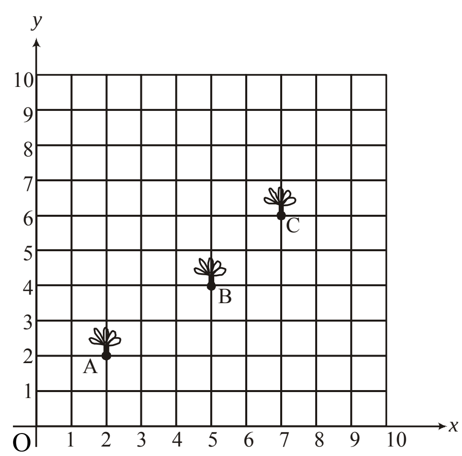
$= 37$ $\frac{1}{2}$

SECTION C

Question numbers 27 to 34 carry 3 marks each.

27. Seema has a 10 m × 10 m kitchen garden attached to her kitchen. She divides it into a 10 × 10 grid and wants to grow some vegetables and herbs used in the kitchen. She puts some soil and manure in that and sows a green chilly plant at A, a coriander plant at B and a tomato plant at C.

Her friend Kusum visited the garden and praised the plants grown there. She pointed out that they seem to be in a straight line. See the below diagram carefully and answer the following questions:



Figure

(i) Write the coordinates of the points A, B and C taking the 10 × 10 grid as coordinate axes.

(ii) By distance formula or some other formula, check whether the points are collinear.

Sol. (i) Coordinates of A, B and C are

(2, 2), (5, 4), (7, 6) $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$

(ii) Area of triangle $= \frac{1}{2}[2(4-6)+5(6-2)+7(2-4)]$ $\frac{1}{2}$

$= 1 \neq 0$ $\frac{1}{2}$

$\therefore$ Points are not collinear $\frac{1}{2}$

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28. In Figure-5, a circle is inscribed in a ΔABC touching BC, CA and AB at P, Q and R respectively. If AB = 10 cm, AQ = 7 cm, CQ = 5 cm, find the length of BC.

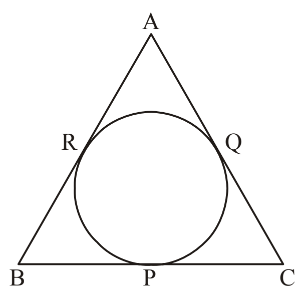

Figure 5

Sol. AR = AQ = 7 cm 1

BR = AB – AR = 10 – 7 = 3 cm $\frac{1}{2}$

BC = BP + PC

= BR + CQ 1

= 3 + 5 = 8 cm $\frac{1}{2}$

OR

In Figure-6, two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ = 2 ∠OPQ.

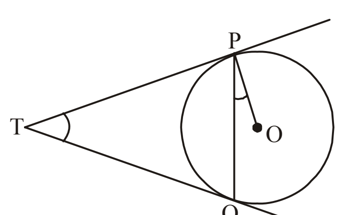

Figure 6

Sol. Let $\angle PTQ = \theta$

$\because$ TP = TQ

$\therefore$ $\angle TPQ = \angle TQP = \frac{1}{2}(180° - \theta)$ 1

$= 90° - \frac{1}{2}\theta$ $\frac{1}{2}$

$\because$ $\angle TPO = 90°$

$\therefore$ $\angle OPQ = 90° - \left(90° - \frac{1}{2}\theta\right)$ 1

$= \frac{1}{2}\theta = \frac{1}{2}\angle PTQ$

$\Rightarrow$ $\angle PTQ = 2\ \angle OPQ$ $\frac{1}{2}$

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29. Prove that $\sqrt{2}$ is an irrational number.

Sol. Let us assume $\sqrt{2}$ is a rational number.

$\therefore$ $\sqrt{2} = \frac{p}{q}$, $q \neq 0$, HCF(p, q) = 1, p & q are integers $\frac{1}{2}$

Squaring both sides

$2 = \frac{p^2}{q^2} \Rightarrow p^2 = 2q^2$ (i)

$\Rightarrow p = 2m$ (ii) 1

Using equations (i) and (ii)

$4m^2 = 2q^2$

$\Rightarrow q = 2m$ (iii) 1

Using equation (ii) and (iii) we get p and q both are multiples of 2 which contradicts the assumption.

Hence $\sqrt{2}$ is an irrational number. $\frac{1}{2}$

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30. **Prove that:**

$$(\text{cosec } \theta - \cot \theta)^2 = \frac{1-\cos\theta}{1+\cos\theta}$$

Sol. LHS = (cosec θ – cot θ)^2

$$= \left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2 \qquad 1$$

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta} \qquad \frac{1}{2}$$

$$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)\,(1+\cos\theta)} \qquad 1$$

$$= \frac{1-\cos\theta}{1+\cos\theta} = \text{R.H.S.} \qquad \frac{1}{2}$$

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31. **5 pencils and 7 pens together cost ₹ 250 whereas 7 pencils and 5 pens together cost ₹ 302. Find the cost of one pencil and that of a pen.**

Sol. Let the cost of 1 pencil be ₹ x and cost of 1 pen be ₹ y.

5x + 7y = 250 ...(i) 1

7x + 5y = 302 ...(ii) 1

Solving (i) and (ii)

x = 36 and y = 10 1

Hence, cost of 1 pencil = ₹ 36

cost of 1 pen = ₹ 10

OR

Solve the following pair of equations using cross-multiplication method:

x – 3y – 7 = 0

3x – 5y – 15 = 0

Sol.
$$\frac{x}{(-3)\,(-15)-(-5)\,(-7)} = \frac{y}{(-7)3-(-15)} = \frac{1}{-5-3(-3)} \qquad 1\frac{1}{2}$$

$$\Rightarrow \frac{x}{10} = \frac{y}{-6} = \frac{1}{4} \qquad \frac{1}{2}$$

$$\Rightarrow x = \frac{5}{2} \qquad \frac{1}{2}$$

$$\Rightarrow y = \frac{-3}{2} \qquad \frac{1}{2}$$

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32. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

(i) a king of red colour.

(ii) the queen of diamonds.

(iii) an ace.

Sol. Toal number of possible outcomes = 52

(i) P(Card is a king of Red colour) = $\frac{2}{52}$ or $\frac{1}{26}$ 1

(ii) P(card is a queen of diamonds) = $\frac{1}{52}$ 1

(iii) P(Card is an ace) = $\frac{4}{52}$ or $\frac{1}{13}$ 1

OR

A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

(i) a two-digit number.

(ii) a perfect square number.

(iii) a prime, number less than 15.

Sol. Total number of possible outcomes = 90

(i) P(a two digit number) = $\frac{81}{90}$ or $\frac{9}{10}$ 1

(ii) P(a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$ 1

(iii) P(a prime number less than 15) = $\frac{6}{90}$ or $\frac{1}{15}$ 1

33. In Figure-7, ABCD is a square of side 14 cm. From each corner of the square, a quadrant of a circle of radius 3.5 cm is cut and also a circle of radius 4 cm is cut as shown in the figure. Find the area of the remaining (shaded) portion of the square.

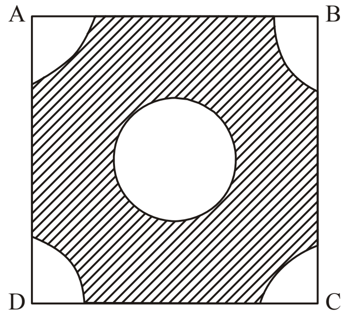

Figure 7

Sol. Area of the square = 14 × 14 = 196 cm^2 $\frac{1}{2}$

Area of middle circle = $\frac{22}{7} \times 4 \times 4 = 50.28 \text{ cm}^2$ 1

Area of four quadrants = $4 \times \frac{1}{4} \times \frac{22}{7} \times 3.5 \times 3.5$

= 38.5 cm^2 1

Hence, Area of Remaining part of square.

= 196 – (50.28 + 38.5)

= 107.22 cm^2 $\frac{1}{2}$

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34. Draw a circle of radius 3 cm. Take a point P outside the circle at a distance of 7 cm from the centre O of the circle and draw two tangents to the circle.

Sol. Drawing a circle and locating point P. 1

Constructing tangents from P. 2

SECTION D

Question numbers 35 to 40 marks each.

35. In a right-angled triangle, prove that the square of the hypotenuse is equal to the sum of the squares of the remaining two sides.

Sol. For correct given, to prove, figure and construction. $4\times\frac{1}{2}=2$

Correct proof 2

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36. Divide polynomial – $x^3 + 3x^2 - 3x - 3x + 5$ by the polynomial $x^2 + x - 1$ and verify the division algorithm.

Sol. On dividing $-x^3 + 3x^2 - 3x + 5$ by $x^2 + x - 1$

We get quotient $= -x + 4$

and Remainder $= -8x + 9$ 2

Verification

$(x^2 + x - 1)(-x + 4) + (9 - 8x)$ 1

$= -x^3 - x^2 + x + 4x^2 + 4x - 4 + 9 - 8x$ $\frac{1}{2}$

$= -x^3 + 3x^2 - 3x + 5$ $\frac{1}{2}$

OR

Find other zeroes of the polynomial

$p(x) = 2x^4 - 3x^3 - 3x^2 + 6x - 2$

if two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

Sol. Two factors of p(x) are $\left(x - \sqrt{2}\right)$ and $\left(x + \sqrt{2}\right)$ $\frac{1}{2}$

$g(x) = \left(x + \sqrt{2}\right)$ and $\left(x - \sqrt{2}\right)$

$= x^2 - 2$ $\frac{1}{2}$

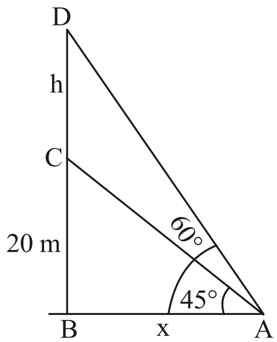
Now, $\dfrac{2x^4 - 3x^3 - 3x^2 + 6x - 2}{x^2 - 2} = 2x^2 - 3x + 1$ 2

Also, $2x^2 - 3x + 1 = (2x - 1)(x - 1)$ $\frac{1}{2}$

Other zeroes are $\frac{1}{2}, 1$ $\frac{1}{2}$

37. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower, fixed at the top of a 20 m high building, are 45° and 60° respectively. Find the height of the tower. (Use $\sqrt{3}$ = 1.73)

Sol. Correct figure 1



$\tan 45° = \frac{20}{x}$

$\Rightarrow x = 20$ m 1

Now, $\tan 60° = \frac{20+h}{x}$

$\Rightarrow \quad 20\sqrt{3} - 20 = h$ 1

$\Rightarrow \quad h = 20\left(\sqrt{3}-1\right)$

$= 20 \times 0.73$

$= 14.6$ m 1

---

38. A bucket is in the form of a frustum of a cone of height 30 cm with the radii of its lower and upper circular ends as 10 cm and 20 cm respectively. Find the capacity of the bucket. (Use π = 3.14)

Sol. Capacity of bucket $= \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$

$= \frac{1}{3} \times 3.14 \times 30(100 + 400 + 200)$ 2

$= 21980$ cm^3 2

OR

Water in a canal 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/hr. How much area will it irrigate in 30 minutes if 4 cm of standing water is needed?

Sol. Length of canal covered by water in 30 min. = 5000 m 1

Volume of water flown in 30 min. = $6 \times 1.5 \times 5000$ m^3 1

Hence, $6 \times 1.5 \times 5000 = (\text{Area of field}) \times \frac{4}{100}$ 1

$\therefore$ Area of field = 1125000 m^2 1

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39. Draw a 'more than' ogive for the following distribution:

Weigth (in kg):	**40 – 44**	**44 – 48**	**48 – 52**	**52 – 56**	**56 – 60**	**60 – 64**	**64 – 68**
Number of Students:	**4**	**10**	**30**	**24**	**18**	**12**	**2**

Sol. Points to be plotted for more than type ogive

(40, 100), (44, 96), (48, 86), (52, 56), (56, 32), (60, 14), (64, 2) 2

For drawing correct ogive 2

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40. A train travels 360 km at a uniform speed. If the speed had been 5 km/hr more, it would have taken 1 hour less for the same journey. Find the original speed of the train.

Sol. Let original speed of the train be x km/h.

$\therefore \frac{360}{x} - \frac{360}{x+5} = 1$ 2

$\Rightarrow x^2 + 5x - 1800 = 0$ 1

$\Rightarrow (x + 45) \quad (x - 40) = 0$

$\Rightarrow x = 40$

$\therefore$ Speed of the train is 40 km/h 1

OR

Sum of the areas of two squares is 468 m^2. If the difference of their parameters is 24 m, find the sides of the two squares.

Sol. Let the side of squares be x m, y m (x > y)

$\therefore x^2 + y^2 = 468$ ...(i) 1

and $4(x - y) = 24$ ...(ii) 1

Simplify (i) and (ii) to get

$x^2 - 6x - 216 = 0$ 1

$\Rightarrow (x - 18)(x + 12) = 0$

$\Rightarrow x = 18$ $\frac{1}{2}$

and $y = 12$ $\frac{1}{2}$

$\therefore$ Sides of square are 18 m and 12 m.

QUESTION PAPER CODE 430/4/2
EXPECTED ANSWER/VALUE POINTS

SECTION A

Question numbers 1 to 20 carry 1 mark each.

Choose the correct option in question numbers 1 to 10.

1. The second term from the end of the A.P. 5, 8, 11, ..., 47 is

(A) 50 (B) 45 (C) 44 (D) 41

Sol. (C) 44 1

---

2. Number of zeroes of the polynomial p(x) shown in Figure-1, are

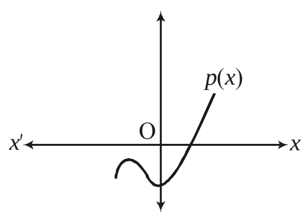


Figure 1

(A) 3 (B) 2 (C) 1 (D) 0

Sol. (C) 1 1

---

3. If sin A = cos A, $0 \leq A \leq 90°$, then the angle A is equal to

(A) 30° (B) 60° (C) 0° (D) 45°

Sol. (D) 45° 1

---

4. Total surface area of a solid hemisphere is

(A) $3\pi r^2$ (B) $2\pi r^2$ (C) $4\pi r^2$ (D) $\frac{2}{3}\pi r^3$

Sol. (A) $3\pi r^2$ 1

---

5. Given that HCF (156, 78) = 78, LCM (156, 78) is

(A) 156 (B) 78 (C) 156 × 78 (D) 156 × 2

Sol. (A) 156 1

---

6. Areas of two similar triangles are in the ratio 16 : 81. Therefore, corresponding sides of these triangles are in the ratio

(A) 9 : 4 (B) 4 : 9 (C) 2 : 3 (D) 16 : 81

Sol. (B) 4 : 9 1

---

7. **The distance between the points (– 1, – 3) and (5, – 2) is**

(A) $\sqrt{61}$ units **(B) $\sqrt{37}$ units** **(C) 5 units** **(D) $\sqrt{17}$ units**

Sol. (B) $\sqrt{37}$ units 1

---

8. **The discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$ is**

(A) – 8 **(B) 10** **(C) 8** **(D) $2\sqrt{2}$**

Sol. (A) –8 1

OR

Roots of the quadratic equation $2x^2 - 4x + 3 = 0$ are

(A) real and equal **(B) real and distinct** **(C) not real** **(D) real**

Sol. (C) Not Real 1

---

9. **The value of k for which the equations $3x - y + 8 = 0$ and $6x + ky = -16$ represent coincident lines, is**

(A) $-\frac{1}{2}$ **(B) $\frac{1}{2}$** **(C) 2** **(D) – 2**

Sol. (D) –2 1

---

10. **A dice is thrown once. The probability of getting an odd number is**

(A) 1 **(B) $\frac{1}{2}$** **(C) $\frac{4}{6}$** **(D) $\frac{2}{6}$**

Sol. (B) $\frac{1}{2}$ 1

Fill in the blanks in question numbers 11 to 15.

11. **For a given distribution with 100 observations, the 'less than' ogive and 'more than' ogive intersect at (58, 50). The median of the distribution is _______.**

Sol. 58 1

---

12. **In a quadratic polynomial $x^2 - 6x$, product of the zeroes is _______.**

Sol. 0 (zero). 1

---

13. **The roots of the equation, $x^2 + bx + c = 0$ are equal if _______.**

Sol. $b^2 = 4c$ 1

---

14. The lengths of the tangents drawn from an external point to a circle are _______.

Sol. Equal 1

---

15. The mid-point of the line segment joining the points (– 3, – 3) and (– 3, 3) is _______.

Sol. (–3, 0) 1

---

16. If cosec θ = $\frac{5}{4}$, find the value of cot θ.

Sol. $\cot^2 \theta = \frac{25}{16} - 1 = \frac{9}{16}$ $\frac{1}{2}$

$\cot \theta = \frac{3}{4}$ $\frac{1}{2}$

OR

Find the value of sin 42° – cos 48°.

Sol. $\sin 42° = \cos (90° - 42°) = \cos 48°$ $\frac{1}{2}$

$\therefore \sin 42° - \cos 48° = 0$ $\frac{1}{2}$

---

17. The angle of elevation of the top of the tower AB from a point C on the ground, which is 60 m away from the foot of the tower, is 30°, as shown in Figure-2. Find the height of the tower.

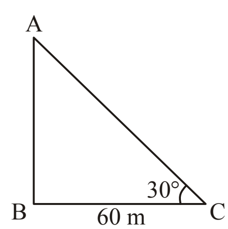


Figure 2

Sol. $\tan 30° = \frac{AB}{60°}$ $\frac{1}{2}$

$\Rightarrow AB = \frac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m $\frac{1}{2}$

---

18. **In Figure-3, find the length of the tangent PQ drawn from the point P to a circle with centre at O, given that OP = 12 cm and OQ = 5 cm.**

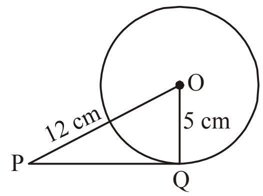


Figure 3

Sol. $PQ^2 = 144 - 25 = 119$ $\frac{1}{2}$

$\therefore$ $PQ = \sqrt{119}$ units $\frac{1}{2}$

---

19. **Write the 31st term of the A.P. –50, – 47, – 44, ...**

Sol. $a_{31} = (-50) + 30 \times 3$ $\frac{1}{2}$

$= 40$ $\frac{1}{2}$

---

20. **Find the coordinates of the point on x-axis which divides the line segment joining the points (2, 3) and (5, – 6) in the ratio 1 : 2.**

Sol. Let the point on x-axis be (x, 0) $\frac{1}{2}$

$\therefore$ Required point is (3, 0) $\frac{1}{2}$

SECTION B

Question numbers 21 to 26 carry 2 marks each.

21. **If sec 2A = cosec (A – 30°), 0° < 2A < 90°, then find the value of ∠A.**

Sol. sec 2A = cosec (A – 30°)

$\Rightarrow$ cosec (90° – 2A) = A – 30° 1

$\Rightarrow$ 90° – 2A = A – 30° $\frac{1}{2}$

$\Rightarrow$ ∠A = 40° $\frac{1}{2}$

---

22. Using Euclid's Division Lemma, find HCF of 54 and 90.

Sol. Using Euclid's division lemma

$90 = 54 \times 1 + 36$ $\frac{1}{2}$

$54 = 36 \times 1 + 18$ $\frac{1}{2}$

$36 = 18 \times 2 + 0$ $\frac{1}{2}$

$\therefore$ HCF of 54 and 90 is 18. $\frac{1}{2}$

---

23. The following table shows the ages of the patients admitted in a hospital during a year:

Age (in years):	**5 – 15**	**15 – 25**	**25 – 35**	**35 – 45**	**45 – 55**	**55 – 65**
Number of patients:	**60**	**110**	**210**	**230**	**150**	**50**

Find the mode of the distribution

Sol. Modal class is 35 – 45 $\frac{1}{2}$

$\therefore$ Mode $= 35 + \frac{230 - 210}{460 - 210 - 150} \times 10$ 1

$= 37$ $\frac{1}{2}$

---

24. How many two-digit numbers are divisible by 6?

Sol. Two digit numbers divisible by 6 are 12, 18, 24,...96 1

$96 = 12 + (n - 1) \times 6$ $\frac{1}{2}$

$\Rightarrow n = 15$ $\frac{1}{2}$

OR

In an A.P. it is given that common difference is 5 and sum of its first ten terms is 75. Find the first term of the A.P.

Sol. $S_{10} = 75$ and $n = 10$ $\frac{1}{2}$

$\frac{10}{2}(2a + 9 \times 5) = 75$ 1

$\Rightarrow a = -15$ $\frac{1}{2}$

---

25. The diameter of a solid metallic sphere is 16 cm. The sphere is melted and recast into solid spherical balls of radius 2 cm. Determine the number of balls.

Sol. r = 8 cm. $\frac{1}{2}$

$\therefore \frac{4}{3}\pi \times 8 \times 8 \times 8 = n \times \frac{4}{3}\pi \times 2 \times 2 \times 2$ 1

$\Rightarrow$ n = 64 $\frac{1}{2}$

---

26. In Figure-4, ΔABC and ΔXYZ are shown. If AB = 3.8 cm, AC = $3\sqrt{3}$ cm, BC = 6 cm, XY = $6\sqrt{3}$ cm, XZ = 7.6 cm, YZ = 12 cm and $\angle A = 65°$, $\angle B = 70°$, then find the value of $\angle Y$.

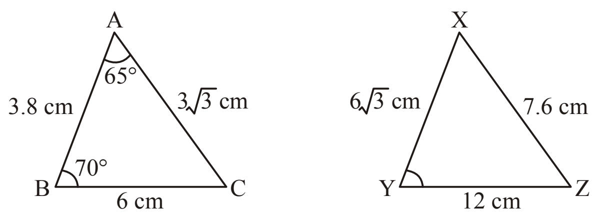


Figure 4

Sol. $\Delta ABC \sim \Delta XZY$ 1

$\Rightarrow \angle Y = \angle C = 180° - (\angle A + \angle B)$ $\frac{1}{2}$

$\Rightarrow \angle Y = 45°$ $\frac{1}{2}$

OR

If the areas of two similar triangles are equal, show that they are congruent.

Sol. Let $\Delta ABC \sim \Delta PQR$

$\therefore \frac{ar(ABC)}{ar(PQR)} = 1 = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$ 1

$\Rightarrow$ AB = PQ, BC = QR, AC = PR $\frac{1}{2}$

$\therefore \Delta ABC \cong \Delta PQR$ (SSS congruence rule) $\frac{1}{2}$

SECTION C

Question numbers 27 to 34 carry 3 marks each.

27. Prove that if $x = a \sin\theta + b \cos\theta$ and $y = a \cos\theta - b \sin\theta$, then $x^2 + y^2 = a^2 + b^2$.

Sol. LHS $= (a \sin\theta + b \cos\theta)^2 + (a \cos\theta - b \sin\theta)^2$

$= a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta + \sin^2\theta)$ 2

$= a^2 + b^2 =$ RHS. 1

---

28. 5 pencils and 7 pens together cost ₹ 250 whereas 7 pencils and 5 pens together cost ₹ 302. Find the cost of one pencil and that of a pen.

Sol. Let the cost of 1 pencil be ₹ x and cost of 1 pen be ₹ y.

$5x + 7y = 250$ ...(i) 1

$7x + 5y = 302$ ...(ii) 1

Solving (i) and (ii)

$x = 36$ and $y = 10$ 1

Hence, cost of 1 pencil = ₹ 36

cost of 1 pen = ₹ 10

OR

Solve the following pair of equations using cross-multiplication method:

$x - 3y - 7 = 0$

$3x - 5y - 15 = 0$

Sol. $$\frac{x}{(-3)(-15)-(-5)(-7)} = \frac{y}{(-7)3-(-15)} = \frac{1}{-5-3(-3)}$$ $1\frac{1}{2}$

$\Rightarrow \frac{x}{10} = \frac{y}{-6} = \frac{1}{4}$ $\frac{1}{2}$

$\Rightarrow x = \frac{5}{2}$ $\frac{1}{2}$

$\Rightarrow y = \frac{-3}{2}$ $\frac{1}{2}$

---

29. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

(i) a king of red colour.

(ii) the queen of diamonds.

(iii) an ace.

Sol. Toal number of possible outcomes = 52

(i) P(Card is a king of Red colour) = $\frac{2}{52}$ or $\frac{1}{26}$ 1

(ii) P(card is a queen of diamonds) = $\frac{1}{52}$ 1

(iii) P(Card is an ace) = $\frac{4}{52}$ or $\frac{1}{13}$ 1

OR

A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

(i) a two-digit number.

(ii) a perfect square number.

(iii) a prime, number less than 15.

Sol. Total number of possible outcomes = 90

(i) P(a two digit number) = $\frac{81}{90}$ or $\frac{9}{10}$ 1

(ii) P(a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$ 1

(iii) P(a prime number less than 15) = $\frac{6}{90}$ or $\frac{1}{15}$ 1

30. In Figure-7, ABCD is a square of side 14 cm. From each corner of the square, a quadrant of a circle of radius 3.5 cm is cut and also a circle of radius 4 cm is cut as shown in the figure. Find the area of the remaining (shaded) portion of the square.

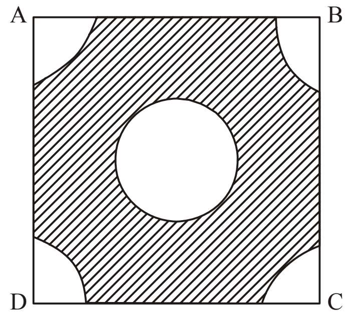


Figure 7

Sol. Area of the square = 14 × 14 = 196 cm^2 $\frac{1}{2}$

Area of middle circle = $\frac{22}{7} \times 4 \times 4 = 50.28\ \text{cm}^2$ 1

Area of four quadrants = $4 \times \frac{1}{4} \times \frac{22}{7} \times 3.5 \times 3.5$

= 38.5 cm^2 1

Hence, Area of Remaining part of square.

= 196 – (50.28 + 38.5)

= 107.22 cm^2 $\frac{1}{2}$

---

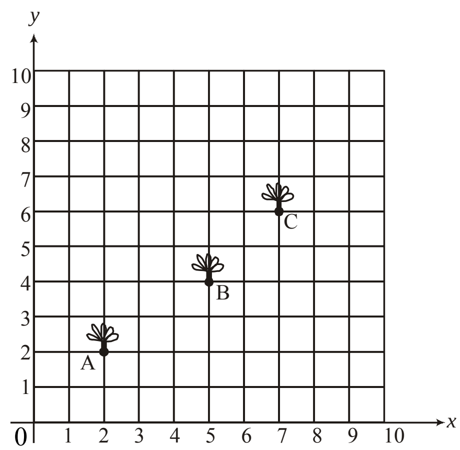
31. Construct an equilateral triangle of side length 5 cm each. Then construct another triangle, whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

Sol. Correct consruction of equilateral triangle. 1

Correct construction of similar triangle. 2

32. **Seema has a 10 m × 10 m kitchen garden attached to her kitchen. She divides it into a 10 × 10 grid and wants to grow some vegetables and herbs used in the kitchen. She puts some soil and manure in that and sows a green chilly plant at A, a coriander plant at B and a tomato plant at C.**

Her friend Kusum visited the garden and praised the plants grown there. She pointed out that they seem to be in a straight line. See the below diagram carefully and answer the following questions:



Figure

(i) Write the coordinates of the points A, B and C taking the 10 × 10 grid as coordinate axes.

(ii) By distance formula or some other formula, check whether the points are collinear.

Sol. (i) Coordinates of A, B and C are

(2, 2), (5, 4), (7, 6) $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$

(ii) Area of triangle $= \frac{1}{2}[2(4-6)+5(6-2)+7(2-4)]$ $\frac{1}{2}$

$= 1 \neq 0$ $\frac{1}{2}$

$\therefore$ Points are not collinear $\frac{1}{2}$

---

33. **Prove that $\sqrt{5}$ is an irrational number.**

Sol. Let $\sqrt{5}$ be a rational number.

$\sqrt{5} = \frac{p}{q}$ where p and q $\neq 0$ are integers and coprime. $\frac{1}{2}$

$\Rightarrow p^2 = 5q^2 \Rightarrow p^2$ is divisible by 5.

$\Rightarrow$ p is divisible by 5 ...(i) 1

Let p = 5m, m is a positive integer.

$\therefore\ 25\ m^2 = 5q^2 \Rightarrow q^2$ is divisible by 5.

$\Rightarrow$ q is divisible by 5. ...(ii) 1

Using (i) and (ii), p and q are not coprime.

Which is contradiction.

Thus $\sqrt{5}$ is an irrational number. $\frac{1}{2}$

---

34. In Figure-5, a circle is inscribed in a ΔABC touching BC, CA and AB at P, Q and R respectively. If AB = 10 cm, AQ = 7 cm, CQ = 5 cm, find the length of BC.

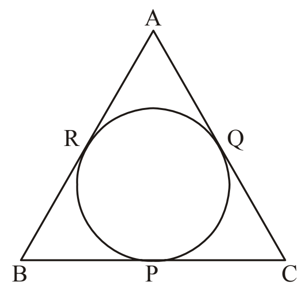


Figure 5

Sol. AR = AQ = 7 cm 1

BR = AB – AR = 10 – 7 = 3 cm $\frac{1}{2}$

BC = BP + PC

= BR + CQ 1

= 3 + 5 = 8 cm $\frac{1}{2}$

OR

In Figure-6, two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle$PTQ = 2 $\angle$OPQ.

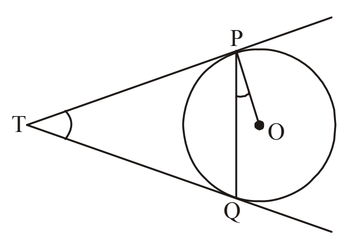


Figure 6

Sol. Let $\angle PTQ = \theta$

$\because$ TP = TQ

$\therefore \angle TPQ = \angle TQP = \frac{1}{2}(180° - \theta)$ 1

$= 90° - \frac{1}{2}\theta$ $\frac{1}{2}$

$\because \angle TPO = 90°$

$\therefore \angle OPQ = 90° - \left(90° - \frac{1}{2}\theta\right)$ 1

$= \frac{1}{2}\theta = \frac{1}{2}\angle PTQ$

$\Rightarrow \angle PTQ = 2\angle OPQ$ $\frac{1}{2}$

SECTION D

Questions numbers 35 to 40 carry 4 marks each.

35. A bucket is in the form of a frustum of a cone of height 30 cm with the radii of its lower and upper circular ends as 10 cm and 20 cm respectively. Find the capacity of the bucket. (Use π = 3.14)

Sol. Capacity of bucket $= \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$

$= \frac{1}{3} \times 3.14 \times 30(100 + 400 + 200)$ 2

$= 21980 \text{ cm}^3$ 2

OR

Water in a canal 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/hr. How much area will it irrigate in 30 minutes if 4 cm of standing water is needed?

Sol. Length of canal covered by water in 30 min. = 5000 m 1

Volume of water flown in 30 min. = $6 \times 1.5 \times 5000 \text{ m}^3$ 1

Hence, $6 \times 1.5 \times 5000 = (\text{Area of field}) \times \frac{4}{100}$ 1

$\therefore$ Area of field = 1125000 m^2 1

36. Draw a 'more than' ogive for the following distribution:

Weigth (in kg):	**40 – 44**	**44 – 48**	**48 – 52**	**52 – 56**	**56 – 60**	**60 – 64**	**64 – 68**
Number of Students:	**4**	**10**	**30**	**24**	**18**	**12**	**2**

Sol. Points to be plotted for more than type ogive

(40, 100), (44, 96), (48, 86), (52, 56), (56, 32), (60, 14), (64, 2) 2

For drawing correct ogive 2

---

37. A train travels 360 km at a uniform speed. If the speed had been 5 km/hr more, it would have taken 1 hour less for the same journey. Find the original speed of the train.

Sol. Let original speed of the train be x km/h.

$\therefore \frac{360}{x} - \frac{360}{x+5} = 1$ 2

$\Rightarrow x^2 + 5x - 1800 = 0$ 1

$\Rightarrow (x + 45) \quad (x - 40) = 0$

$\Rightarrow x = 40$

$\therefore$ Speed of the train is 40 km/h 1

OR

Sum of the areas of two squares is 468 m^2. If the difference of their parameters is 24 m, find the sides of the two squares.

Sol. Let the side of squares be x m, y m (x > y)

$\therefore x^2 + y^2 = 468$ ...(i) 1

and $4(x - y) = 24$ ...(ii) 1

Simplify (i) and (ii) to get

$x^2 - 6x - 216 = 0$ 1

$\Rightarrow (x - 18)\ (x + 12) = 0$

$\Rightarrow x = 18$ $\frac{1}{2}$

and $y = 12$ $\frac{1}{2}$

$\therefore$ Sides of square are 18 m and 12 m.

---

38. Prove that the ratio of areas of two similar triangles is equal to the ratio of square of their corresponding sides.

Sol. Correct given, to prove, construction, figure $4\times\frac{1}{2} = 2$

Correct proof 2

---

39. Divide polynomial – $x^3 + 3x^2 - 3x - 3x + 5$ by the polynomial $x^2 + x - 1$ and verify the division algorithm.

Sol. On dividing $-x^3 + 3x^2 - 3x + 5$ by $x^2 + x - 1$

We get quotient $= -x + 4$

and Remainder $= -8x + 9$ 2

Verification

$(x^2 + x - 1)(-x + 4) + (9 - 8x)$ 1

$= -x^3 - x^2 + x + 4x^2 + 4x - 4 + 9 - 8x$ $\frac{1}{2}$

$= -x^3 + 3x^2 - 3x + 5$ $\frac{1}{2}$

OR

Find other zeroes of the polynomial

$p(x) = 2x^4 - 3x^3 - 3x^2 + 6x - 2$

if two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

Sol. Two factors of p(x) are $\left(x-\sqrt{2}\right)$ and $\left(x+\sqrt{2}\right)$ $\frac{1}{2}$

$g(x) = \left(x+\sqrt{2}\right)$ and $\left(x-\sqrt{2}\right)$

$= x^2 - 2$ $\frac{1}{2}$

Now, $\frac{2x^4 - 3x^3 - 3x^2 + 6x - 2}{x^2 - 2} = 2x^2 - 3x + 1$ 2

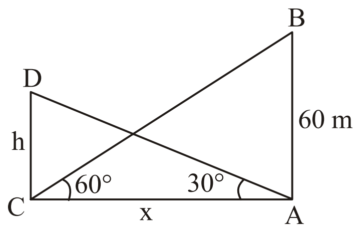
Also, $2x^2 - 3x + 1 = (2x - 1)(x - 1)$ $\frac{1}{2}$

Other zeroes are $\frac{1}{2}, 1$ $\frac{1}{2}$

---

40. The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of top of the tower from foot of the building is 60°. If the tower is 60 m high, then find the height of the building.

Sol. Let AB be the tower and CD be the building. Correct figure 1



$\tan 60° = \sqrt{3} = \dfrac{60}{x}$

$\Rightarrow x = \dfrac{60}{\sqrt{3}}$ ...(i) 1

$\tan 30° = \dfrac{1}{\sqrt{3}} = \dfrac{h}{x}$

$\Rightarrow h = \dfrac{x}{\sqrt{3}}$ ...(ii) 1

Solving (i) and (ii) to get h = 20

Height of the building is 20 m. 1

QUESTION PAPER CODE 430/4/3
EXPECTED ANSWER/VALUE POINTS
SECTION A

Question numbers 1 to 20 carry 1 mark each.

Choose the correct option in question numbers 1 to 10.

1. In Figure-1, number of zeroes of the polynomial p(x), shown in the graph are

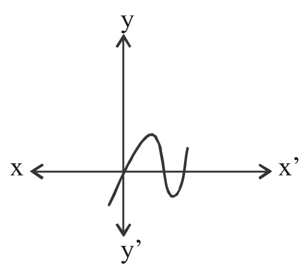


Figure 1

(A) 3 **(B) 2** **(C) 1** **(D) 4**

Sol. (A) 3 1

---

2. A dice is thrown once. The probability of getting an odd number is

(A) 1 **(B)** $\frac{1}{2}$ **(C)** $\frac{4}{6}$ **(D)** $\frac{2}{6}$

Sol. (B) $\frac{1}{2}$ 1

---

3. The value of k for which the equations $3x - y + 8 = 0$ and $6x + ky = -16$ represent coincident lines, is

(A) $-\frac{1}{2}$ **(B)** $\frac{1}{2}$ **(C) 2** **(D) – 2**

Sol. (D) –2 1

---

4. If $\sin A = \cos A$, $0 \leq A \leq 90°$, then the angle A is equal to

(A) 30° **(B) 60°** **(C) 0°** **(D) 45°**

Sol. (D) 45° 1

---

5. Total surface area of a solid hemisphere is

(A) $3\pi r^2$ **(B)** $2\pi r^2$ **(C)** $4\pi r^2$ **(D)** $\frac{2}{3}\pi r^3$

Sol. (A) $3\pi r^2$ 1

---

6. **The second term from the end of the A.P. 5, 8, 11, ..., 47 is**

(A) 50 **(B) 45** **(C) 44** **(D) 41**

Sol. (C) 44 1

---

7. **Sides of two similar triangles are in the ratio 4 : 9. Areas of these triangles are in the ratio**

(A) 4 : 9 **(B) 2 : 3** **(C) 81 : 16** **(D) 16 : 81**

Sol. (D) 16 : 81 1

---

8. **Given that HCF (156, 78) = 78, LCM (156, 78) is**

(A) 156 **(B) 78** **(C) 156 × 78** **(D) 156 × 2**

Sol. (A) 156 1

---

9. **The discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$ is**

(A) – 8 **(B) 10** **(C) 8** **(D) $2\sqrt{2}$**

Sol. (A) –8 1

OR

Roots of the quadratic equation $2x^2 - 4x + 3 = 0$ are

(A) real and equal **(B) real and distinct** **(C) not real** **(D) real**

Sol. (C) Not Real 1

---

10. **The distance between the points (– 1, – 3) and (5, – 2) is**

(A) $\sqrt{61}$ units **(B) $\sqrt{37}$ units** **(C) 5 units** **(D) $\sqrt{17}$ units**

Sol. (B) $\sqrt{37}$ units 1

Fill in the blanks in question numbers 11 to 15.

11. **The lengths of the tangents drawn from an external point to a circle are _______.**

Sol. Equal 1

---

12. **In the quadratic polynomial $t^2 - 16$, sum of the zeroes is _______.**

Sol. 0 1

---

13. **The distance between the points (– a, a) and (– a, – a) is _______.**

Sol. 2a 1

---

14. **The roots of the equation, $x^2 + bx + c = 0$ are equal if _______.**

Sol. $b^2 = 4c$ 1

---

15. **For a given distribution with 100 observations, the 'less than' ogive and 'more than' ogive intersect at (58, 50). The median of the distribution is _______.**

Sol. 58 1

---

16. **Find the coordinates of the point on x-axis which divides the line segment joining the points (2, 3) and (5, – 6) in the ratio 1 : 2.**

Sol. Let the point on x-axis be (x, 0) $\frac{1}{2}$

$\therefore$ Required point is (3, 0) $\frac{1}{2}$

---

17. **The angle of elevation of the top of the tower AB from a point C on the ground, which is 60 m away from the foot of the tower, is 30°, as shown in Figure-2. Find the height of the tower.**

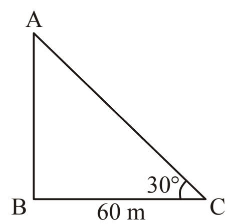


Figure 2

Sol. $\tan 30° = \frac{AB}{60°}$ $\frac{1}{2}$

$\Rightarrow AB = \frac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m $\frac{1}{2}$

Answer the following question numbers 16 to 20.

18. **Write the 26th term of the A.P. 7, 4, 1, –2, ...**

Sol. d = –3 $\frac{1}{2}$

$a_{26} = -68$ $\frac{1}{2}$

---

19. **In Figure-3, PT is tangent to a circle centered at O. Find the value of ∠OTP if ∠POT = 75°.**

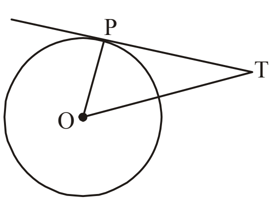


Figure 3

Sol. OP ⊥ PT ⇒ ∠OPT = 90° $\frac{1}{2}$

Hence, ∠OTP = 90° – 75º = 15° $\frac{1}{2}$

20. If cosec θ = $\frac{5}{4}$, find the value of cot θ.

Sol. $\cot^2\theta = \frac{25}{16} - 1 = \frac{9}{16}$ $\frac{1}{2}$

cot θ = $\frac{3}{4}$ $\frac{1}{2}$

OR

Find the value of sin 42° – cos 48°.

Sol. sin 42° = cos (90° – 42°) = cos 48° $\frac{1}{2}$

∴ sin 42° – cos 48° = 0 $\frac{1}{2}$

SECTION B

Question numbers 21 to 26 carry 2 marks each.

21. If tan 2A = cot (A – 18°) where 2A and (A – 18°), both are acute angles, find the value of A.

Sol. cot (90° – 2A) = cot (A – 18°) 1

⇒ 3A = 108° $\frac{1}{2}$

⇒ A = 36° $\frac{1}{2}$

22. The following table shows the ages of the patients admitted in a hospital during a year:

Age (in years):	**5 – 15**	**15 – 25**	**25 – 35**	**35 – 45**	**45 – 55**	**55 – 65**
Number of patients:	**60**	**110**	**210**	**230**	**150**	**50**

Find the mode of the distribution.

Sol. Modal class is 35 – 45 $\frac{1}{2}$

∴ Mode = $35 + \frac{230-210}{460-210-150} \times 10$ 1

= 37 $\frac{1}{2}$

23. Given that the HCF of two numbers is 11 and their LCM is 693. If one of the numbers is 77, then find the other number.

Sol. Other number = $\dfrac{11\times 693}{77}$ 1

$= 99$ 1

---

24. A cylindrical bucket, 32 cm high and with radius of base 14 cm, is filled completely with sand. Find the volume of the sand. (Use $\pi = \dfrac{22}{7}$)

Sol. Volume of sand = $\dfrac{22}{7}\times 14\times 14\times 32$ 1

$= 19712\ \text{cm}^3$ 1

---

25. In Figure-4, ΔABC and ΔXYZ are shown. If AB = 3.8 cm, AC = $3\sqrt{3}$ cm, BC = 6 cm, XY = $6\sqrt{3}$ cm, XZ = 7.6 cm, YZ = 12 cm and $\angle$A = 65°, $\angle$B = 70°, then find the value of $\angle$Y.

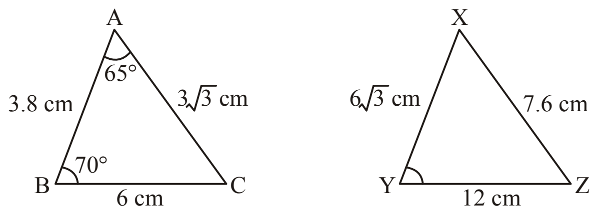


Figure 4

Sol. $\Delta ABC \sim \Delta XZY$ 1

$\Rightarrow \angle Y = \angle C = 180° - (\angle A + \angle B)$ $\frac{1}{2}$

$\Rightarrow \angle Y = 45°$ $\frac{1}{2}$

OR

If the areas of two similar triangles are equal, show that they are congruent.

Sol. Let $\Delta ABC \sim \Delta PQR$

$\therefore \dfrac{ar(ABC)}{ar(PQR)} = 1 = \dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{AC^2}{PR^2}$ 1

$\Rightarrow AB = PQ,\ BC = QR,\ AC = PR$ $\frac{1}{2}$

$\therefore \Delta ABC \cong \Delta PQR$ (SSS congruence rule) $\frac{1}{2}$

---

26. How many two-digit numbers are divisible by 6?

Sol. Two digit numbers divisible by 6 are 12, 18, 24,...96 1

$96 = 12 + (n - 1) \times 6$ $\frac{1}{2}$

$\Rightarrow n = 15$ $\frac{1}{2}$

OR

In an A.P. it is given that common difference is 5 and sum of its first ten terms is 75. Find the first term of the A.P.

Sol. $S_{10} = 75$ and $n = 10$ $\frac{1}{2}$

$\frac{10}{2}(2a + 9 \times 5) = 75$ 1

$\Rightarrow a = -15$ $\frac{1}{2}$

SECTION C

Question numbers 27 to 34 carry 3 marks each.

27. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

(i) a king of red colour.

(ii) the queen of diamonds.

(iii) an ace.

Sol. Toal number of possible outcomes = 52

(i) P(Card is a king of Red colour) = $\frac{2}{52}$ or $\frac{1}{26}$ 1

(ii) P(card is a queen of diamonds) = $\frac{1}{52}$ 1

(iii) P(Card is an ace) = $\frac{4}{52}$ or $\frac{1}{13}$ 1

OR

A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

(i) a two-digit number.

(ii) a perfect square number.

(iii) a prime, number less than 15.

Sol. Total number of possible outcomes = 90

(i) P(a two digit number) = $\frac{81}{90}$ or $\frac{9}{10}$ 1

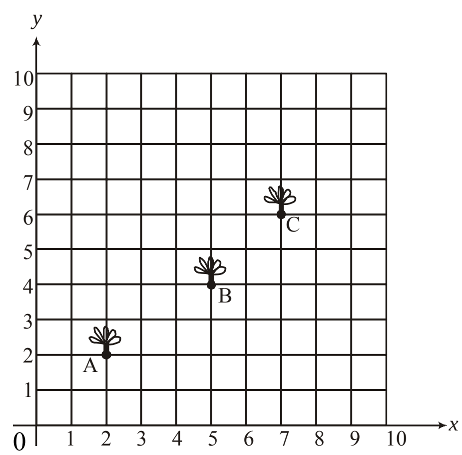
(ii) P(a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$ 1

(iii) P(a prime number less than 15) = $\frac{6}{90}$ or $\frac{1}{15}$ 1

---

28. Seema has a 10 m × 10 m kitchen garden attached to her kitchen. She divides it into a 10 × 10 grid and wants to grow some vegetables and herbs used in the kitchen. She puts some soil and manure in that and sows a green chilly plant at A, a coriander plant at B and a tomato plant at C.

Her friend Kusum visited the garden and praised the plants grown there. She pointed out that they seem to be in a straight line. See the below diagram carefully and answer the following questions:



Figure

(i) Write the coordinates of the points A, B and C taking the 10 × 10 grid as coordinate axes.

(ii) By distance formula or some other formula, check whether the points are collinear.

Sol. (i) Coordinates of A, B and C are

(2, 2), (5, 4), (7, 6) $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$

(ii) Area of triangle = $\frac{1}{2}\left[2(4-6)+5(6-2)+7(2-4)\right]$ $\frac{1}{2}$

$= 1 \neq 0$ $\frac{1}{2}$

$\therefore$ Points are not collinear $\frac{1}{2}$

---

29. **Draw a circle of radius 4 cm. Take a point P at a distance of 8 cm from the centre and construct a pair of tangents from point P to the circle.**

Sol. Drawing a circle of radius 4 cm and locating point P. 1

Correct construction of tangents. 2

---

30. **Prove that $\sqrt{3}$ is an irrational number.**

Sol. Let $\sqrt{3}$ be a rational number.

Let $\sqrt{3} = \frac{p}{q}$, p, q $\neq$ 0 are integers and coprime. $\frac{1}{2}$

$\Rightarrow p^2 = 3q^2 \Rightarrow p^2$ is divisible by 3.

$\Rightarrow$ p is divisible by 3. ...(i) 1

Let p = 3m, m is a positive integer.

$\therefore\ 9m^2 = 3q^2 \Rightarrow q^2$ is divisible by 3.

$\Rightarrow$ q is divisible by 3. ...(ii) 1

Using (i) and (ii), p and q are not coprime.

Which is contradiction.

Thus $\sqrt{3}$ is an irrational no. $\frac{1}{2}$

---

31. **In Figure-5, a chord AB of a circle of radius 10 cm subtends a right angle at the centre.**

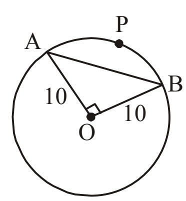


Figure 5

Find

(i) Area of sector OAPB

(ii) Area of minor segment APB. (Use π = 3.14)

Sol. (i) Area of sector OAPB = $\frac{90°}{360°} \times 3.14 \times 100 = 78.5\ \text{cm}^2$ $1\frac{1}{2}$

(ii) Area minor segment APB = Area sector OAPB – Area ΔOAB

$$= 78.5 - \frac{1}{2} \times 100$$ 1

$$= 28.5 \text{ cm}^2.$$ $\frac{1}{2}$

---

32. 5 pencils and 7 pens together cost ₹ 250 whereas 7 pencils and 5 pens together cost ₹ 302. Find the cost of one pencil and that of a pen.

Sol. Let the cost of 1 pencil be ₹ x and cost of 1 pen be ₹ y.

$5x + 7y = 250$ ...(i) 1

$7x + 5y = 302$ ...(ii) 1

Solving (i) and (ii)

$x = 36$ and $y = 10$ 1

Hence, cost of 1 pencil = ₹ 36

cost of 1 pen = ₹ 10

OR

Solve the following pair of equations using cross-multiplication method:

$x - 3y - 7 = 0$

$3x - 5y - 15 = 0$

Sol. $$\frac{x}{(-3)(-15)-(-5)(-7)} = \frac{y}{(-7)3-(-15)} = \frac{1}{-5-3(-3)}$$ $1\frac{1}{2}$

$$\Rightarrow \frac{x}{10} = \frac{y}{-6} = \frac{1}{4}$$ $\frac{1}{2}$

$$\Rightarrow x = \frac{5}{2}$$ $\frac{1}{2}$

$$\Rightarrow y = \frac{-3}{2}$$ $\frac{1}{2}$

---

33. **Prove that:**

$$(\text{cosec } \theta - \cot \theta)^2 = \frac{1 - \cos\theta}{1 + \cos\theta}$$

Sol. LHS = (cosec θ – cot θ)^2

$$= \left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2 \qquad 1$$

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta} \qquad \frac{1}{2}$$

$$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)\,(1+\cos\theta)} \qquad 1$$

$$= \frac{1-\cos\theta}{1+\cos\theta} = \text{R.H.S.} \qquad \frac{1}{2}$$

---

34. **In Figure-5, a circle is inscribed in a ΔABC touching BC, CA and AB at P, Q and R respectively. If AB = 10 cm, AQ = 7 cm, CQ = 5 cm, find the length of BC.**

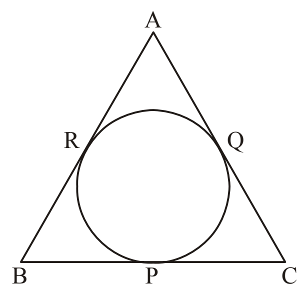


Figure 5

Sol. AR = AQ = 7 cm $\qquad 1$

BR = AB – AR = 10 – 7 = 3 cm $\qquad \frac{1}{2}$

BC = BP + PC

= BR + CQ $\qquad 1$

= 3 + 5 = 8 cm $\qquad \frac{1}{2}$

OR

In Figure-6, two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ = 2 ∠OPQ.

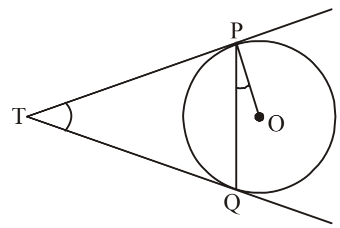


Figure 6

Sol. Let $\angle PTQ = \theta$

$\because$ TP = TQ

$\therefore \angle TPQ = \angle TQP = \frac{1}{2}(180° - q)$ 1

$= 90° - \frac{1}{2}\theta$ $\frac{1}{2}$

$\because \angle TPO = 90°$

$\therefore \angle OPQ = 90° - \left(90° - \frac{1}{2}\theta\right)$ 1

$= \frac{1}{2}\theta = \frac{1}{2}\angle PTQ$

$\Rightarrow \angle PTQ = 2\angle OPQ$ $\frac{1}{2}$

SECTION D

Question numbers 35 to 40 carry 4 marks each.

35. A bucket is in the form of a frustum of a cone of height 30 cm with the radii of its lower and upper circular ends as 10 cm and 20 cm respectively. Find the capacity of the bucket. (Use π = 3.14)

Sol. Capacity of bucket $= \frac{1}{3}ph(r_1^2 + r_2^2 + r_1 r_2)$

$= \frac{1}{3} \times 3.14 \times 30(100 + 400 + 200)$ 2

$= 21980 \text{ cm}^3$ 2

OR

Water in a canal 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/hr. How much area will it irrigate in 30 minutes if 4 cm of standing water is needed?

Sol. Length of canal covered by water in 30 min. = 5000 m 1

Volume of water flown in 30 min. = $6 \times 1.5 \times 5000$ m^3 1

Hence, $6 \times 1.5 \times 5000 = (\text{Area of field}) \times \frac{4}{100}$ 1

$\therefore$ Area of field = 1125000 m^2 1

36. Draw a 'less than' ogive for the following distribution:

Classes:	**0 – 10**	**10 – 20**	**20 – 30**	**30 – 40**	**40 – 50**	**50 – 60**	**60 – 70**
Frequency:	**8**	**5**	**7**	**14**	**18**	**6**	**2**

Sol. Finding points (10, 8) (20, 13) (30, 20) (40, 34) (50, 52) (60, 58) (70, 60) 2

Plotting the points correctly and getting ogive. 2

37. A train travels 360 km at a uniform speed. If the speed had been 5 km/hr more, it would have taken 1 hour less for the same journey. Find the original speed of the train.

Sol. Let original speed of the train be x km/h.

$\therefore \frac{360}{x} - \frac{360}{x+5} = 1$ 2

$\Rightarrow x^2 + 5x - 1800 = 0$ 1

$\Rightarrow (x + 45) \quad (x - 40) = 0$

$\Rightarrow x = 40$

$\therefore$ Speed of the train is 40 km/h 1

OR

Sum of the areas of two squares is 468 m^2. If the difference of their parameters is 24 m, find the sides of the two squares.

Sol. Let the side of squares be x m, y m (x > y)

$\therefore x^2 + y^2 = 468$ ...(i) 1

and $4(x - y) = 24$ ...(ii) 1

Simplify (i) and (ii) to get

$x^2 - 6x - 216 = 0$ 1

$\Rightarrow$ (x – 18) (x + 12) = 0

$\Rightarrow$ x = 18 $\frac{1}{2}$

and y = 12 $\frac{1}{2}$

$\therefore$ Sides of square are 18 m and 12 m.

---

38. Divide polynomial $-x^3 + 3x^2 - 3x - 3x + 5$ by the polynomial $x^2 + x - 1$ and verify the division algorithm.

Sol. On dividing $-x^3 + 3x^2 - 3x + 5$ by $x^2 + x - 1$

We get quotient = $-x + 4$

and Remainder = $-8x + 9$ 2

Verification

$(x^2 + x - 1)(-x + 4) + (9 - 8x)$ 1

$= -x^3 - x^2 + x + 4x^2 + 4x - 4 + 9 - 8x$ $\frac{1}{2}$

$= -x^3 + 3x^2 - 3x + 5$ $\frac{1}{2}$

OR

Find other zeroes of the polynomial

$p(x) = 2x^4 - 3x^3 - 3x^2 + 6x - 2$

if two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

Sol. Two factors of p(x) are $\left(x - \sqrt{2}\right)$ and $\left(x + \sqrt{2}\right)$ $\frac{1}{2}$

g(x) = $\left(x + \sqrt{2}\right)$ and $\left(x - \sqrt{2}\right)$

$= x^2 - 2$ $\frac{1}{2}$

Now, $\dfrac{2x^4 - 3x^3 - 3x^2 + 6x - 2}{x^2 - 2} = 2x^2 - 3x + 1$ 2

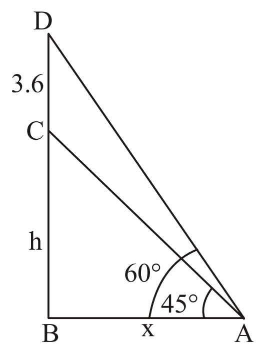
Also, $2x^2 - 3x + 1 = (2x - 1)(x - 1)$ $\frac{1}{2}$

Other zeroes are $\frac{1}{2}, 1$ $\frac{1}{2}$

---

39. A statue 3.6 m tall, stands on top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point, the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal.

Sol.



Correct Figure 1

Let CD be the statue and BC be the pedestal.

$\tan 60° = \sqrt{3} = \dfrac{h+3.6}{x} \Rightarrow x = (h+3.6)/\sqrt{3}$ ...(i) 1

$\tan 45° = \dfrac{h}{x} = 1 \Rightarrow x = h$ ...(ii) 1

Solving (i) and (ii) to get

$h = \dfrac{3.6}{\sqrt{3}-1} = 1.8\,(\sqrt{3}+1)$ m

Height of the pedestal is $1.8(\sqrt{3}+1)$m 1

---

40. In a right-angled triangle, prove that the square of the hypotenuse is equal to the sum of the squares of the remaining two sides.

Sol. For correct given, to prove, figure and construction. $4\times\frac{1}{2}=2$

Correct proof 2